Transport Demand Management Tools for Metro Rail System-

Strategy to ease congestion in DMRC

Mentor: Prof Sanjay Gupta, SPA Delhi

Priya Agrawal
Amit Kumar Jain
INDIAN RAILWAYS

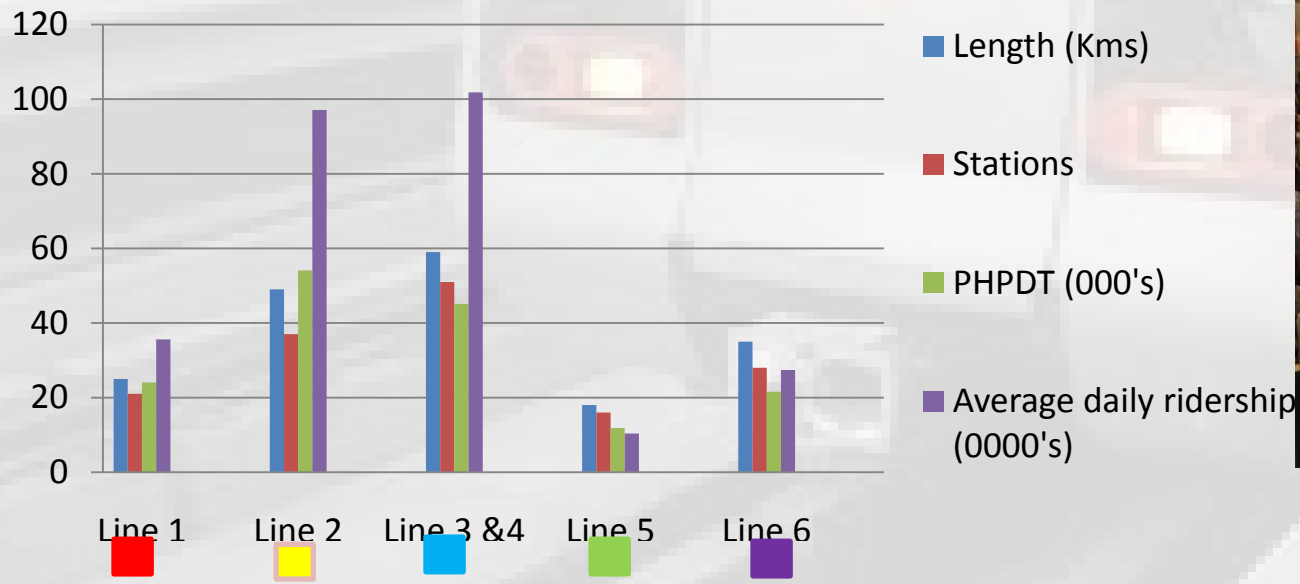
Agenda

- Operational Highlights of Delhi Metro
- LOS: Assessment of Congestion in Delhi Metro
- Supply side measures taken to ease congestion
- Proposed Demand management techniques
- Status of implementation

Delhi Metro: Operation Highlights

- Network Length: **194 Km** (Excluding AEL)
- Stations: **158 stations** (by Line)
- Average Ridership: **2.8 million**
- Avg. train trips per day: **2930 (weekdays)**
- Total number of train cars: **1542**

- Minimum Headway : **2'09"**
- Train running with a punctuality **99.9%**
- Service Reliability – **99.9%**
- Passenger Safety – **Very High**
- **Step free** access at all stations



LOS as a measure of Congestion

LOS at walkway, Observed area (L 21.6 m x W 4.2 m)
Location- F block, Rajiv Chowk
LOS - C

LOS inside Delhi Metro Train

LOS D (with train at PF)

Measures adopted to ease congestion

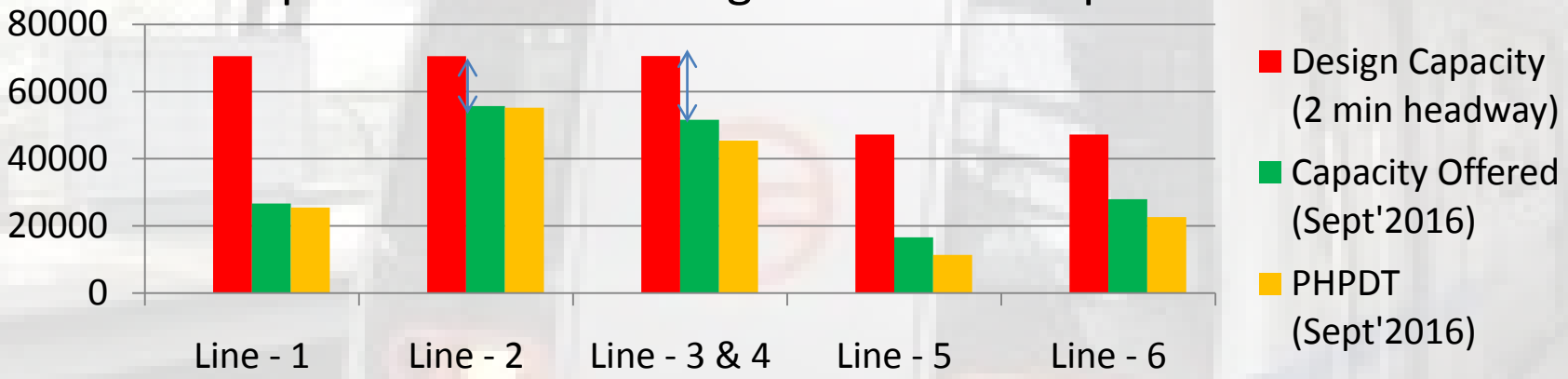
Challenges
Meet the growing travel demand
Ease Congestion
Remain financially viable
Optimum utilisation of capacity
Maintain Level of service, safety and Punctuality

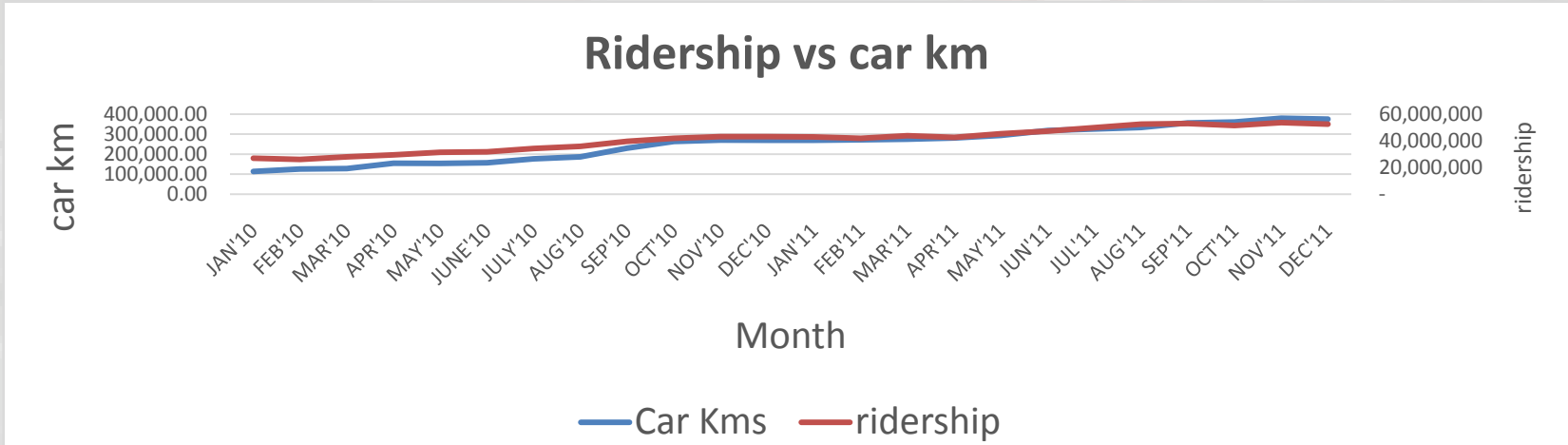
Supply Side Measures Taken
Increase in trains: Runs 27 trains /hour in yellow line
Increase in cars per train: Converting 4 car trains to 6 car trains and 6 car trains to 8 car trains in busy lines
Auto Turn back (ATB) of trains, front & rear crossovers at terminals to **reduce turn around time**
Intermediate reversal (rather than end stations) to **improve availability** in the high demand section
Use of **Automatic Train Operations** to improve efficiency
Additional trains during the peak hour in peak direction
Real time demand monitoring

Need for Demand side Measures

Supply side measures

- Can be adopted only to the extent of infrastructure capacity.
- Intensive capital required for further expansion
- Sub-optimal utilization of capacity created
- Inadequate to address congestion in short period of time.





Demand Management Tools

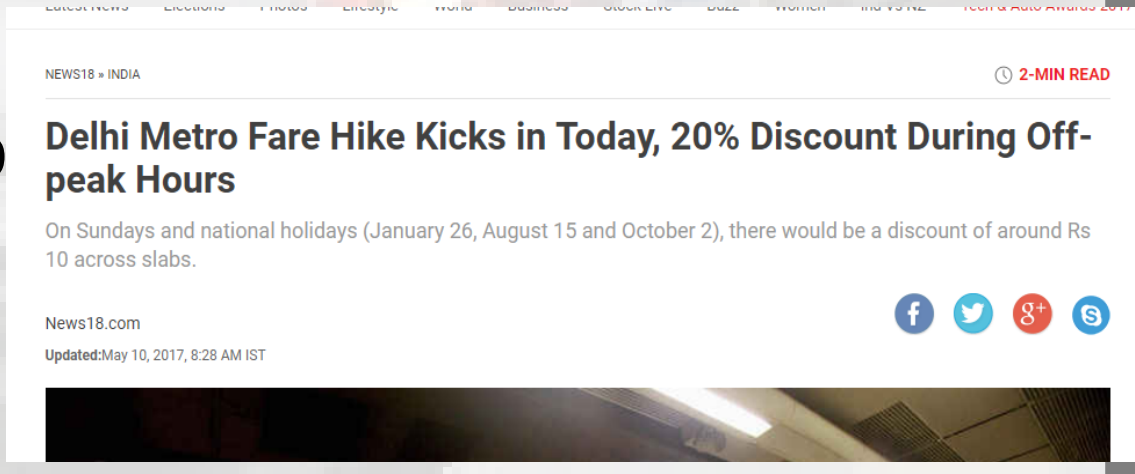
Operator's strategy	Government's Intervention
Differential pricing Higher fares during peak hours- lower during non peak hours	Mix land use & Polycentric city Development of multiple CBDs
Parking Policies Higher rates for peak hours to encourage non peak travel	Integrated Fares Integrated fares for multiple modes of public transport
Incentives for travel in non peak hour Facilities to sr. citizens & disabled, reduced fare	Work from Home Employers to encourage work from home. E.g Hong Kong
Network Design – Radial to Circular Re-distributing demand over circular lines rather than radial lines	Staggered office/ school timings Staggering the timings of the to smoothen peak travel demand
Promote non congested routes Reduced fares and better feeder bus connectivity	Bicycling Promote use of bicycles (separate lanes, cycle stands) to allow for hassle free change of mode

Measure 1: Differential Pricing

- Internationally adopted measure for TDM e.g London Underground, New York Subway
- Increase fare box revenue because of low price elasticity in peak hours
- ***Price elasticity model*** to be considered
- Help reduce peak hour congestion.
- Implementation strategy
  - Automatic Fare Collection system
  - Exit time is to be considered for fare calculation

Status **IMPLEMENTED**

DMRC has implemented differential fares w.e.f 10th May, 2017.



NEWS18 » INDIA

2-MIN READ

Delhi Metro Fare Hike Kicks in Today, 20% Discount During Off-peak Hours

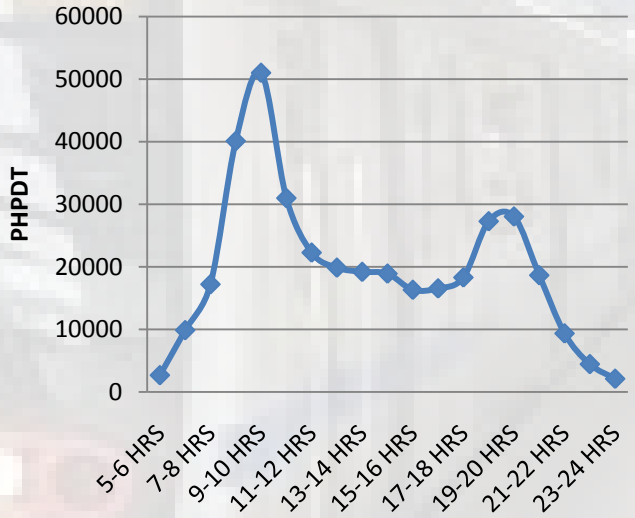
On Sundays and national holidays (January 26, August 15 and October 2), there would be a discount of around Rs 10 across slabs.

News18.com

Updated:May 10, 2017, 8:28 AM IST

Measure1: Implementation

- An additional 20% discount is offered to the passengers using Smart Card who exit from metro system during off peak hours based on the following time zones:
  - Start of revenue services to 08:00 AM.
  - From 12.00 Noon to 05.00 PM.
  - From 09:00 PM to closing of revenue service
- The above discount is applicable from Monday to Saturday.
- Further special discount is offered on Sundays and National Holidays to attract more ridership on these days.



PUBLIC NOTICE

As part of the two phase revision of Metro fares recommended by the 4th Fare Fixation Committee, fares under Phase-II of Fare revision are as given below:

Revised Fares (Monday to Saturday)

Distance zones (KMs.)	Old fare with token as on 9th October 2017	w.e.f 10th October 2017 with token (₹)	w.e.f 10th October 2017 with Smart Card during peak hours (₹)	w.e.f 10th October 2017 with Smart Card during non-peak hours (₹)
0-2	10	10	9	8
2-5	15	20	18	16
5-12	20	30	27	24
12-21	30	40	36	32
21-32	40	50	45	40
>32	50	60	54	48

Revised Fares on Sundays and National Holidays (-26th Jan, 15th Aug & 2nd Oct.)

Distance zones (KMs.)	Old fare with token as on 9th October 2017	w.e.f 10th October 2017 with token (₹)	w.e.f 10th October 2017 with Smart Card (₹)
0-2	10	10	9
2-5	10	10	9
5-12	10	20	18
12-21	20	30	27
21-32	30	40	36
>32	40	50	45

24 X 7 HELP LINE – 155370

For further details, please visit DMRC website **www.delhimetrorail.com**

Enjoy the Benefits of Off-Peak Hours

20% discount for Smart Card passengers entering Metro System during off peak hours*

Window of almost 11 hours provided as non-peak hours:

	From	Till
Off-Peak Hours	Start of revenue services	Before 8:00 AM
	12:00 Noon	Before 5:00 PM
	9:00 PM	Close of revenue services

*Cumulative i.e. 10% discount on Smart Card + 10% discount during off-peak hours

Safe and convenient commute for women

- Women only coach in every train.
- Reserved seats for women in every coach.
- CCTV surveillance at stations, platforms and in train coaches.
- Female CISF staff have been deployed at stations for frisking of lady passengers.

Senior citizens

- Reserved seats, lifts and escalators, ramps

DELHI METRO
मेरा मेट्रो

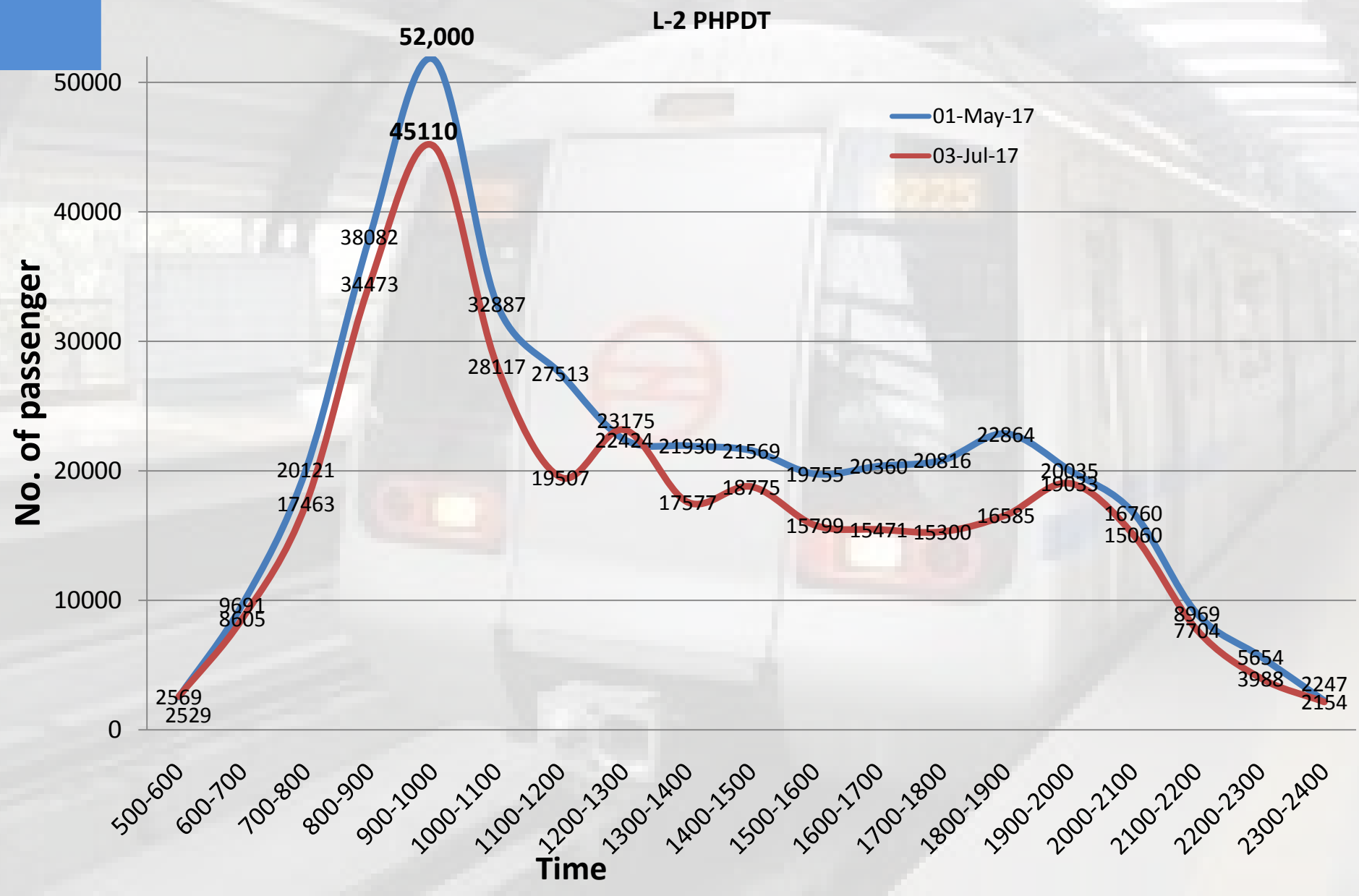
DELHI METRO RAIL CORPORATION

Measure 2: Capacity augmentation in non- peak hours

- Capacity augmentation in Non peak hours along with differential fares is effective in shifting demand from peak to non peak hours.
- DMRC has informed that they have increased frequency of trains in non peak hours

No.	Year	Line-1		Line-2		Line-3/4		Line-5		Line-6	
		Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak	Peak	Off-Peak
1	Mar-2015	3'15"	5'00"	2'50"	3'24"	2'36"	2'52"	4'38"	5'24"	3'09"	6'00"
2	Mar-2017	3'15"	3'53"	2'40"	2'45"	2'30"	2'42"	3'38"	4'38"	3'20"	4'00"

Capacity Augmentation and Differential Pricing: Impact on Yellow Line



Measure 3: Enhancing ridership on non- congested routes

Congested route	Proposed alternate routes for promotion of ridership	Strategy
Dwarka 21-Rajiv Chowk (Blue line)	Dwarka 21- New Delhi (Airport Line)	Rationalization of fares of Airport line, Convenient interchange at Dwarka 21
Faridabad-Rajiv chowk via CTST-RCK	Faridabad-Rajiv Chowk via CTST-MDHS	More services on violet line Convenient interchange at Mandi House (MDHS)
Mundaka –Rajiv Chowk via Inderlok	Mundaka-Rajiv Chowk via Kirtinagar	More services to Kirtinagar Convenient interchange at kirtinagar Originating services on redline

In phase III, with more number of interchange stations, the alternate routes shall be promoted to decongest the existing routes.

Measure 3: Implementation

- DMRC is promoting non congested routes Airport Express Line as an alternative to blue line through media campaigns, interaction with passengers, announcements, etc: ***Around 5% riders of Blue line have been shifted to Airport Line.***

- Mandi House-CTST route is being promoted as an alternative to Rajiv Chowk-CTST- ***Decongested Rajiv Chowk***

- ***This strategy will be further pursued after commissioning of phase III.***

Measure 4: Rationalisation of feeder routes

- The feeder bus may be provided at non-congested stations to shift traffic

Status **IMPLEMENTED**

- Rationalized feeder bus routes to connect non congested stations with feeder buses
- 11 routes rationalized
- 8 New feeder bus routes added

Delhi govt fixes routes of Metro feeder buses to improve last-mile connectivity

Buses that bring Delhi Metro stations closer for residents will run on new and improved routes. The State Transport Authority aims to rationalise the routes so that they help remove congestion in the Capital.

DELHI Updated: Jan 18, 2017 14:20 IST

Sweta Goswami
Hindustan Times

Measure 5: Network Redesign

- Conversion of radial network to grid network helps in reducing the peak hour demand towards CBD

Case for DMRC:

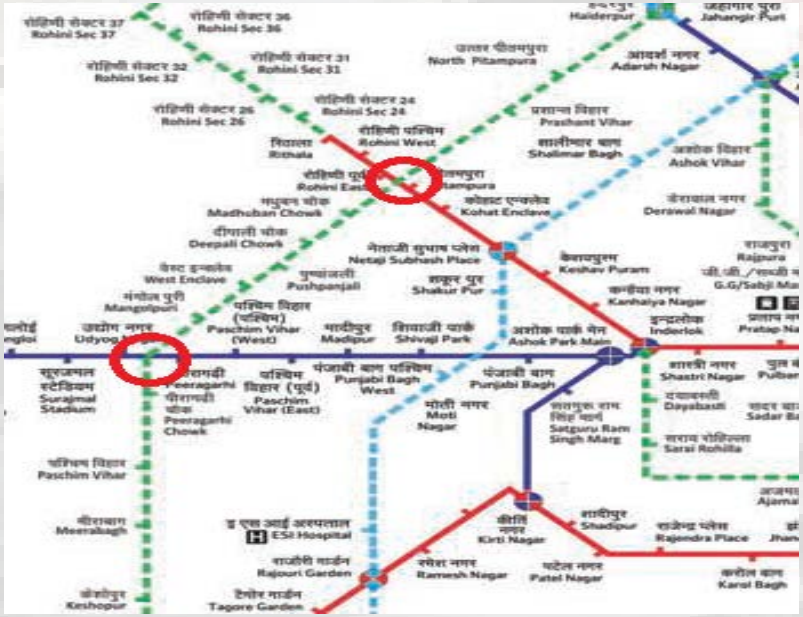
- Excessive congestion is witnessed at ***Rajiv Chowk*** *(RCK)*- ***Central Secretariat*** *(CTST)*
  - ✓ Serves Connaught Place, the CBD of Delhi
  - ✓ Transfer station between two most popular lines – yellow line and blue line
- *Mandi House (MDHS) – Central Secretariat as an extension of phase II*
- In absence of MDHS, RCK would have been 22% more congested

- Phase III of DMRC is focussed on developing circular lines and creating grid network to offer more opportunities to transfer
- ***14 more interchange stations planned for Phase 3***

Recommendations for Phase IV

- **Janakpuri West- Mukundpur corridor have interchange with**
  - ➢ Green line at Peera Garhi station
  - ➢ Red line at Rohini East station

- **Connect Vaishali (VASI) - Noida City Centre(NCC)**
- Create YB-VASI-NCC-YB circular line to reduce interchange at Yamuna Bank (YB) (~ 50,000 commuters)



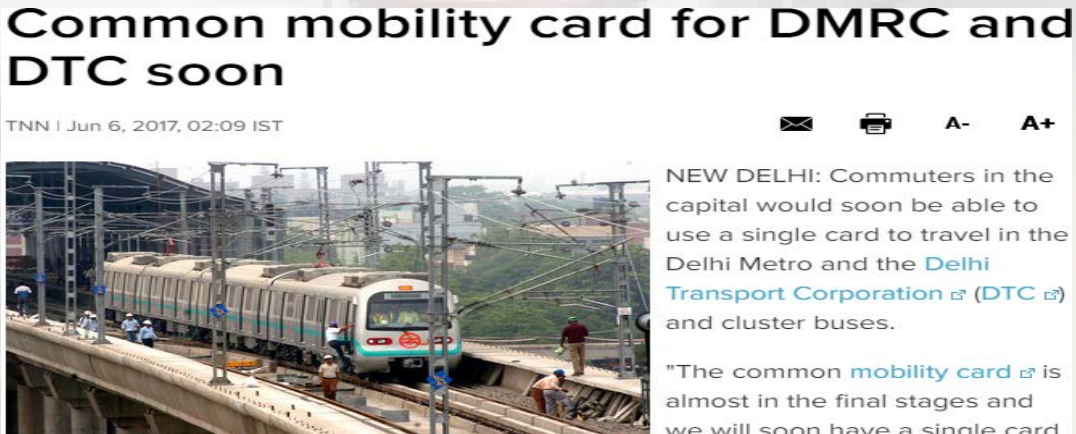
The suggestion is well taken and will be considered in phase IV planning

Measure 6: Integration with Other Modes

- Physical and information Integration of DMRC with DTC and cluster bus by DIMTS
- Operational integration through *Single fare card/ticket* with incentives to travel in non peak hour

Status **IMPLEMENTED**

- Multi Modal Integration-UTTIPEC
- The DMRC smart card will be integrated with DTC
- Trials to integrate the two systems have completed successfully.



Common mobility card for DMRC and DTC soon

TNN | Jun 6, 2017, 02:09 IST

A- A+

NEW DELHI: Commuters in the capital would soon be able to use a single card to travel in the Delhi Metro and the Delhi Transport Corporation (DTC) and cluster buses.

"The common mobility card is almost in the final stages and

Measure 7: Parking Policies

PROPOSED

- Higher parking charges during peak hours and at congested stations
  - *Example: Parking at Vaishali station may be made costlier than at Kaushambi*
- **Free parking for Bicycles** to encourage use of bicycle for shorter distances
- **Implementation Strategy**
  - AFC smart card for parking payment
  - Differential Parking rates can be fixed and deducted from smart card.

DMRC Response

- DMRC has recently finalized parking policy wherein it is envisaged to collect parking charges by way of use of smart cards.
- The user gets additional discount if the parked vehicle is collected from the parking lot within 60 minutes of exit through AFC Gate.

CIN No. U74899DL 1995G0I068150

दूरभाष Tel. : 23417910/12
फैक्स Fax : 23417921

दिल्ली मेट्रो रेल कॉर्पोरेशन लि०
DELHI METRO RAIL CORPORATION LTD.
(भारत सरकार एंव दिल्ली सरकार का संयुक्त उपक्रम)
(A JOINT VENTURE OF GOVERNMENT OF INDIA AND GOVT. OF DELHI)

To

Dated, the 14th July 2017

Mr. Amit Kumar Jain
Director Traffic Commercial Railway Board

Ms Priya Agarwal
Dy. CSTE, Railways

Sub: - Project report – Leaders Programme in Urban Transport Planning and Management

Ref: - Your letter dated 31.03.2017

Dear Ms. Priya and Mr. Jain

First I would like to thank you and CEPT for choosing a very pertinent issue faced by Delhi Metro for your project work. Delhi Metro with average ridership of 2.8 million, is facing the problem of congestion in peak hours. Your project report aptly discusses various measures which can be applied to manage peak hour demand in metro systems to reduce peak hour congestion. Delhi Metro has taken a slew of measures to ease congestion in peak hours in metro trains. A summary of measures taken by Delhi Metro vis-à-vis suggestions made in the report are presented in the Table below: -

S/N	Suggestions in the Report	Measures taken by DMRC
1.	Differential fares	DMRC has implemented differential fares w.e.f. 10th May, 2017. To avoid overcrowding during peak hours, an additional 10% discount is given to the passengers using Smart Card who exit from metro system during off-peak hours based on the following time zones: - • Start of revenue services to 08:00 AM • From 12:00 Noon to 05:00 PM. • From 09:00 PM to closing of revenue service The above discount is applicable from Monday to Saturday only. Thus, in all a passenger may avail 20% discount on smart card while travelling during the off-peak time. Further special discount is offered on Sundays and National Holidays to attract more ridership on these days.
2.	Integration with other modes	DMRC Smart Card will be integrated with DTC and can be used on DTC buses also. For the purpose trials to integrate the fare mechanism is presently underway.
3.	Network Design - Multiple interchange points	The availability of interchange points helps in spatial distribution of the demand. In phase-III of DMRC, 14 additional interchange stations have been planned. The suggestion is well taken and will be considered in phase-IV planning of DMRC.
4.	Parking Policies	DMRC has recently finalized parking policy wherein it is envisaged to collect parking charges by way of use of smart cards. Once implemented, the user may get additional discount if the parked vehicle is collected from the parking lot within 60 minutes of exit through AFC Gate.

5.	Time Tabling – Supply more than demand in off peak hours to attract leisure travelers/Sr. Citizens etc. in off peak hours	To attract non commuters in non-peak hours, DMRC has increased number of trains in non-peak hours. Line wise position of headways in peak and non-peak hours for last three years is shown in Annexure-A.
6.	Promote non congested routes in case of multiple routes	DMRC is promoting non congested routes Airport Express Line as an alternative to blue line through media campaigns, interaction with passengers, announcements, etc. Similarly, Mandi House-CTST route is being promoted as an alternative to Rajiv Chowk-CTST to decongest Rajiv Chowk Metro station. These efforts have helped in decongesting the busy lines/stations. With coming up of more alternative routes in Phase-III, the promotion of non congested routes will be enhanced.
7	Rationalization of feeder bus routes	DMRC has rationalized feeder bus routes to connect relatively non congested stations with feeder buses so as to divert the traffic from busy stations to lean stations. The new feeder bus routes are made operational to decongest the busy stations & lines. The details of route rationalized and new routes added during last one year are shown in Annexure-B.

At the end I would again like to thank you again for excellent work which is very suitable in the present context for Delhi Metro. I am sure that this work will be useful for other metro systems also.

Vikas Kumar

(Vikas Kumar)
Executive Director/Operations
DMRC

THANK YOU